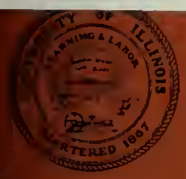

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Justifying the Strategic Use of Information Technology

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ABSTRACT

This article presents a methodology to justifying the strategic use of information technology, called value-advantage-risk (VAR) analysis. The basic premise of this methodology is that there is no long-term sustainable competitive advantage. In other words, every competitive weapon has a life cycle, called the "competitive edge life cycle (CELC)". The analysis recommends that the manager first identify the value of a system and then determine to what extent the value can be converted into a competitive advantage. In addition, since strategic information systems are future-oriented, competition-driven, and strategy-dependent, the competitor's strategy and the risks associated with these spplications must be taken into consideration in justifying the systems.

INTRODUCTION

In the past several years, the rapid proliferation of information technology (IT) has drawn considerable attention to its strategic implication. A growing amount of literature concerning how this technology can be used strategically to gain competitive advantage has been presented [e.g., Gerstein & Reisman, 1982; McFarlan, McKinney & Pyburn, 1983; Parson, 1983; Rockart & Scott Morton, 1984; Benjamin, et al., 1984; McFarlan, 1984; Ives & Learmonth, 1984; Cash & Konsynski, 1985; Rockoff, Wiseman & Ullrich, 1985; Bankos & Treacy, 1986; Henderson & Treacy, 1986; Clemons & Kimbrough, 1986; Malone, Yates & Benjamin, 1986; Vitale, Ives & Beath, 1986; Learmonth & Ives, 1987]. This literature analyzes existing IT applications and provides advice to top management based on, at least implicitly, an assumption that strategic use of IT can create a sustainable competitive advantage. Examples widely discussed include:

- Airline Reservation Systems

  The airline reservation systems have successfully doubled the percentage of bookings through travel agents (from 35% to 70%) Two carriers, American and United, have installed their systems in nearly 80% of the travel agencies in the U.S. and hence gained a tremendous competitive advantage.

- American Hospital Supply

  Since 1976, American Hospital Supply (AHS) has provided an order entry and distribution system that directly links its customers to AHS computers. The system allows customers to perform functions for themselves, such as inventory control, and thereby generate increased customer royalty and market share.

- Cash Management Accounts

  Merrill Lynch introduced cash management accounts that combined charge card, checking account, and brokerage service into one account in the late 70's. Now the company still enjoys a very large market share.

- McKesson Drug Company

  McKesson Drug uses an interorganizational information system to link customers. The system helps the customers in all aspects of managing their pharmacies, including order entry, restocking, and billing.

Behind these successful stories, however, there are probably even more cases where applications of IT generate little, if any at all, competitive advantage. One obvious example is the automated teller machines (ATMs). Now most commercial banks spend a substantial amount of money to maintain their ATMs, which provide almost no competitive advantage. Another example is TWA's self-service ticket machines, which can directly sell tickets to customers [Gifford & Spector, 1984]. These machines even failed to be accepted by customers, although they did provide better customer service.

What were wrong with these strategic uses (or misuses) of information technology? ATMs have become a routine business, whereas automated ticket machines failed from the very beginning. VisiCalc, the first spreadsheet software, is no longer on the market. What are the implications of these overlooked cases?

All these examples suggest that, contrary to the implicit assumption mentioned earlier, the strategic use of IT has the following characteristics:

1. No generally applicable IT strategy

   Although appropriate use of IT may have generated a competitive advantage for some organizations, it is not true that early technology adopters will always benefit most. Therefore, before rushing into the IT jungle, each organization must evaluate its own situation to set up the optimum strategy.

2. No generally applicable IT

   An IT that has been proven successful in one industry may not be able to survive in another. Even in the same industry, the technology that creates an advantage for one company may not work for another. Hence, each organization must identify its own strategic needs and select appropriate technology that supports these needs.

3. No long-term sustainable competitive advantage

> Because of technological progress and market efficiency, every competitive weapon has a life cycle. We shall call this the "competitive edge life cycle" (CELC). Theoretical studies also support that under certain conditions it is impossible to create a long-term sustainable competitive advantage [Tang, 1987]. Although long development time and high development costs are likely to create competitive advantages through building up entry barriers and increasing switching costs, they also increase the critical fixities of a firm, which force the firm to tie to a particular technology and prevent it from switching to a newer technology [Tang & Zannetos, 1986]. As IT progresses, this will enable entrants with better technology to outperform incumbent firms. As a result, a leap-frog type of competition will occur. The major concern in developing strategic information systems (SIS) is, therefore, not to argue whether an advantage is sustainable but to measure how long the advantage can last.

In other words, the strategic use of IT is not without risk. Rather, the environment uncertainty and the future-oriented nature of SIS may result in a risk higher than that of a traditional system. Consequently, justification is very important.

The primary purpose of this article is to examine how SIS can be properly justified. Traditional cost-benefit analysis is not adequate for evaluating the strategic use of IT. Most SIS involve qualitative and future-oriented benefits; whereas the traditional cost-benefit approach focuses on quantitative measures. In addition, SIS are competition-oriented. That is, costs for system development are usually a secondary consideration.

In the next section, literature pertaining to the strategic use of IT will be reviewed. Then, a framework for SIS justification, called Value-Advantage-Risk (VAR) analysis, will be presented. Most of the previous research tends to use values and competitive advantages interchangeably. In fact, they are different. The value of a new system is the incremental contribution of the system compared to the existing system in the organization. The competitive advantage of a system, however, is compared to similar systems

adopted by competitors. Allowing the decision maker to examine more alternatives, for example, is considered the value of a decision support system (DSS) [Keen, 1981]. If the DSS does not outperform the competitor's system, however, the DSS provides no competitive advantage. Information systems (IS) that add value to the existing system may not be able to generate a competitive advantage. In addition, because of the risks associated with the strategic use of IT, IS that generate advantages may not be able to sustain. Therefore, a proper justification must take into account all of these factors.

STRATEGIC USE OF INFORMATION TECHNOLOGY

The idea of using IT as a competitive weapon has evolved through three generations. Early research in studying the impact of technology on corporate strategy focused on technology as a whole. It was considered only part of the technological world. For example, Kantrow [1980] stated that "it is essential to integrate technology into business decision-making" and "technological decisions are of fundamental importance to business and therefore must be made in the fullest context of each company's strategic thinking."

Because of the increasing importance of IT, research of the second generation concentrated specifically on the characteristics of IT [e.g., Parson, 1983; McFarlan, 1984; Rockoff, et al., 1985]. Most of this research examined strategic implications at the micro level; that is, how a particular firm can take advantage of IT. The frameworks for analysis were Porter's five competitive forces [1980, 1985] or Wiseman's five competitive thrusts [1985].

Recently, the focus of research has shifted to the macro level. Articles discussing the impact of IT on market structure have

increased. Concepts and frameworks in industrial economics have become popular and Williamson's transaction cost analysis [1975] has been widely cited [e.g., Clemons & Kimbrough, 1986; Malone, et al., 1986]. In this section, selected previous research will be briefly reviewed. A summary of their incremental contributions is illustrated in Figure 1.

INSERT FIGURE 1

MICRO ANALYSIS

Analyses at the micro level approach the issue from a particular firm's standpoint. In other words, how a particular firm in an industry can take advantage of IT to outperform other firms. Its major concerns include identification of strategic opportunities, selection of IT, IS planning, and allocation of resources.

In early 1982, Gerstein and Reisman realized that the potential of IT was underexploited and managers were losing out on valuable opportunities without even realizing it. They suggested that data processing planning be carried out along with the company's strategic planning. In the article, a system analysis matrix was presented for assessing the costs and benefits as well as the strategic risks and rewards associated with major investments in computer technology. The matrix classifies IS applications into operationally critical systems and systems capable of providing competitive advantage. Since these two types of systems have different focuses, they should be evaluated differently depending upon their location in the matrix.

McFarlan, McKinney and Pyburn [1983] observed the importance of IS planning. They developed a strategic matrix that classified IS

environments in terms of the strategic impact of existing operating systems and the strategic impact of application development portfolio and examined Porter's three generic strategies: low-cost leadership, product differentiation, and market focus. Four environments were identified: support, turnaround, factory, and strategic. Different environments require different degrees of top management involvement in IS planning.

Parsons [1983] expanded the research scope from matrix-based analysis to three hierarchical levels that cover both micro and macro analyses. At the industry level, he argued that IT may change the very nature of the industry's products and services, the markets, and the basic economics of production in some industries. At the firm level, IT will affect the balance of the five competitive forces: the entry of new competitors, the threat of substitutes, the bargaining power of buyers, the bargaining power of suppliers, and the rivalry among the existing competitors. This work was among the first that applied Porter's framework to the analysis of SIS. At the strategy level, IT may have impact on Porter's three generic strategies. Since the importance of IT varies from firm to firm, he stated that IT applications must be specifically chosen to support the generic strategy of a firm.

Several following articles concentrated on exploring strategic opportunities for IT uses. Rockart and Scott Morton [1984] suggested that potential applications of IT can be identified by examining the value-added chain of a firm. Ives and Learmonth [1984] proposed that the modified thirteen-stage customer resources life cycle can be used to identify when opportunities exist for strategic applications and what specific applications should be developed. Benjamin, et al. [1984] also presented a strategic opportunities matrix that helps

senior executives identify strategic applications of IT. It required that each senior manager focus on the following two questions:

1. Can I use the technology to make a significant change in the way we are now doing business so my company can gain a competitive advantage?

2. Should we, as a company, concentrate on using IT to improve our approach to the marketplace? Or, should we center our efforts on internal improvements in the way we currently carry out the activities of the firm?

McFarlan's later work [1984] integrated his strategic matrix with Porter's five competitive forces and presented several guidelines for resource allocation and management:

1. The end product of IS planning must clearly communicate the true competitive impact of the expenditures involved;

2. Resources must be allocated to areas with the most growth potential;

3. Managers should take appropriate steps to ensure the confidentiality of SIS planning and thinking;

4. Executives should not permit the use of simplistic rules to calculate desirable IS expense levels;

5. Managers should not ignore interorganizational IS; and

6. Managers must not be too efficiency-oriented in IS resource allocation.

Instead of using Porter's framework, Rockoff, et al. [1985] adopted Wiseman's five strategic thrusts [1985]: differentiation, cost, innovation, growth, and alliance. These thrusts strike at three classes of strategic targets: suppliers, customers, and competitors. According to the framework, they developed a five-step planning process for identifying stategic opportunities:

1. Introduce information management (IM): chief executive to SIS concepts,

2. Conduct SIS idea-generation meeting for IM middle management,

3. Conduct SIS idea-generation meeting for IM executives,

4. Introduce top business executives to SIS concept, and
5. Conduct SIS idea-generation meeting for corporate business planners.

Bakos and Treacy [1986] analyzed the effect of IT on internal, competitive, and business portfolio strategies. Their analysis indicated that IT may affect the internal strategy by changing the capacity, quality, and unit cost for information storage, processing, or communications; IT may affect the competitive strategy by changing the bargaining power and comparative efficiency; and IT may affect the portfolio strategy by changing industry structure and efficient boundaries.

Recent research also studied the impact of a particular technology. For example, Cash and Konsynski [1985] researched the impact of interorganizational systems on competition and Henderson and Treacy [1986] examined the competitive advantage of end-user computing.

In summary, previous research at the micro level has developed many frameworks for strategic use of IT. Most of them examine the issue from a particular firm's perspective and stress that early adopters of IT will be able to build up a competitive advantage by either increasing their bargaining power or improving their internal efficiency.

The major weakness of this type of analysis, however, is that it fails to consider other firms' actions. Given that IT is conveniently available, it is safe to assume that the market of IT is fairly efficient. In other words, no firm is the only one that can take advantage of IT. It is unlikely that other firms will sleep and wait while someone is building up a competitive advantage. If every firm in the industry takes similar actions, then the result

will be significantly different from the conclusion drawn by micro analysis. This understanding has initiated two other streams of research: macro analysis and risk analysis.

MACRO ANALYSIS

Analyses at the macro level focus on the impact of IT on industry structure. An individual firm's interest is not of major concern, although it is usually possible for a firm to derive a proper strategy from the results of macro analysis. The macro analysis is important because the selection of the proper strategy depends on accurate analysis of the environment. Therefore, unless we have correctly foreseen the change of market structure, it would be very difficult to assess the risk associated with a strategic move, no matter whether that move involves IT or not.

In an early research, Parsons [1983] discussed the impact of IT at the industry level. He presented the following three observations that in some industries:

1. IT may substantially alter the product life cycle and signicantly increase the speed of distribution;
2. IT may significantly change the market. Traditional rules of competition will change; and
3. IT may change the basic economics of production. New economies of scale will evolve and entry barriers will erode in one area and spring up others. The value-added stream will be redistributed.

Williamson's transaction cost approach [1975] provides the theoretical foundation for most recent research at the macro level. In general, he examines the relative efficiency of organizational hierarchies and market mechanisms by comparing production and transaction costs. Since markets allow production resources to be shared among more buyers, they have lower production costs. Markets, however, also require buyers to collect more information, which

results in higher coordination costs. The effect of a particular technology on market structure, therefore, depends upon how the technology affects the production and transaction costs respectively.

Unfortunately, research conclusions based on this model have been conflicting. For example, Bakos and Treacy [1986] adopted Williamson's efficient boundaries hypothesis and suggested that the flexibility of IT will lead to larger organizations and less market mechanisms. Malone, Yates, and Benjamin [1986], on the other hand, stated that IT should favor market mechanisms and recommended that "all firms should consider whether more of the activities they currently perform internally could be performed less extensively or more flexibly by outside suppliers whose selection and work could be coordinated by computer-based systems."

Since research at the macro level is still at its infancy, this kind of conflict is probably inevitable. It does, however indicate that much research is needed in this area. There are at least two potential research directions. First, models built for competition in a technology race, such as Barzel [1968], Kamein & Schwartz, 1972, and Reinganum [1985], can be used to calibrate the impact of IT. These models explicitly consider the behavior of a particular firm in response to the behavior of other firms. In addition, research concentrated on entry with new technology and escalating commitment to the wrong technology, such as Tang and Zannetos [1986], is also very relevant to the strategic use of IT. Second, empirical research must be conducted. Conflicting arguments may be considered two different hypotheses. Only empirical studies can decide what the true impact of IT will be.

RISK ANALYSIS

Given the overwhelming interest in promoting strategic uses of

IT, it is not surprising that someone has blown the whistle. As stated earlier, the strategic use of IT is not a panacea. It has risks. Because of our poor understanding about the possible impact of IT, the risks are probably much higher than that of a traditional system.

With this understanding, Vitale [1986] observed the following risks:

1. Basis of competition: a rush decision to use IT as a strategic weapon may trigger counter actions from stronger competitors and hence result in damage to the firm;

2. Entry Barriers: IS, on the one hand, will increase the cost and difficulty of entry. On the other hand, it may also help competitors to penetrate your market;

3. Switching costs: increased switching costs may eventually incur legal actions against unfair competition; IT may also unintentionally reduce switching cost;

4. Balance of power: the increased importance of IT may reduce a firm's bargaining power against IT vendors; and

5. New product development: development of new IS-based product may consume too much financial resources and, consequently, reduce the company's profit.

To use IT strategically, therefore, the manager must assess and also manage its potential risks. Vitale proposed a matrix adapted from McFarlan, et al. [1983] for assessing risks. The framework asks the manager to evaluate current impact and future impact of IS and then develop the company's long-term strategy accordingly.

This research has provided some insight about the risks associated with the strategic use of IT. The framework for assessing the risk, however, is rather primitive. The guidelines for managing risks are also too general to be useful. In addition, risk analysis alone is not sufficient for justifying the strategic use of IT. To be useful, the framework for justification must also consider the

following two questions:

1. What is the value of the system? and
2. What competitive advantage can the system create?

JUSTIFYING STRATEGIC INFORMATION SYSTEMS

Traditionally, there are two methods for evaluating IS: cost-benefit analysis [Emery, 1971; King & Schrems, 1978] and value analysis [Keen, 1981]. The primary purpose of cost-benefit analysis is to balance the cost against the benefits associated with an IS project. In general, it focuses on tangible costs and benefits and needs to quantify qualitative factors. This confines its capability to justify systems with significant intangible benefits, such as DSS.

Value analysis is a modified version of cost-benefit analysis. It involves a two-step process that requires the decision maker to evaluate a prototype before justifying the full-scale system. The basic philosophy is "value first, cost second." It also emphasizes innovation rather than routinization.

However, neither of these methods satisfies the requirements for evaluating SIS, because SIS have the following characteristics:

1. SIS are future-oriented;

   Unlike other types of IS, the benefits of SIS are long-term oriented. In addition, it is usually very difficult to quantify them. For example, if a company plans to implement a telecommunication system that links customers' computers to its central computer, the strategic implication is definitely not limited to the benefit of electronic mail.

2. SIS are competition-driven;

   The motivation for developing SIS is usually not tangible benefits. It is the competition that drives the development of SIS. The major concerns are how and to what extent competitive advantages can be created. Justifying SIS, therefore, must take into account the competitor's reaction. In other words, the basis for justification is not the existing system but the competitor's system with which this system is going to compete.

3. SIS are strategy-dependent;

   The strategic use of IT is part of the general business strategy. It is, therefore, important to examine whether the SIS support the business strategy. For instance, developing a strategic system that provides luxury services is probably not justifiable for a company pursuing the low-cost leadership strategy.

The justification of SIS must take into consideration these features. In the following section, a methodology is presented.

VAR ANALYSIS

VAR analysis includes the following three components:

1. Value analysis: determine the value of the SIS,
2. Advantage analysis: evaluate how and to what extent the value of the system can be converted into competitive advantage, and
3. Risk analysis: assess the strategic risk associated with the system.

1. Value Analysis

The first step to justify a SIS is to determine the value of the system. In other words, we want to know how the new system improves the performance of the existing system. If a system provides no improvement over the existing system, it is unlikely that it would create any competitive advantage.

The value of SIS can be tangible or intangible. Most of the tangible benefits result from the improvement of operating efficiency and are reflected as cost and time savings. For example, a material requirement planning (MRP) system can significantly reduce the inventory level and consequently minimize the inventory cost.

In addition to the tangible benefits, it is more important to examine the intangible value of SIS. Depending upon the technology adopted, a SIS may have the following values:

1. Higher entry barrier;

   IT investment may prevent potential entrants from entering the market and hence increase existing entry barriers.

2. Higher bargaining power;

   IT investment may increase the switching cost and, as a result, increase the bargaining power against customers and suppliers.

3. Better product or service;

   IT may be built into existing products or services to enhance their value.

4. Better decision making;

   IT may be used to support decision making and lead to better decision performance.

In justifying SIS, therefore, it is important to make sure that the system provides some of these benefits.

2. Advantage Analysis

Since competition is extremely dynamic, a system that adds value to a firm may not be able to create a competitive advantage. Providing a market analysis service to news stands, for example, can increase the bargaining power of a magazine distributor. However, if its competitors immediately offer similar systems that produce more accurate demand forecasts, then the anticipated value will never be realized. The key point, therefore, is not how IT can be used but how well IT can be used. The competitor's strategy must be seriously considered.

For each firm, there are two strategies for promoting SIS: proactive and reactive [Urban & Hauser, 1980]. The proactive strategy recommends the firm be an innovator; whereas the reactive strategy suggests the firm be a follower that quickly copies a valuable application. Although the innovator may have a better opportunity to

create an advantage, the follower is able to take advantage of new technology and also avoid innovation risks. In other words, when the competitor's strategies are taken into consideration, each firm is facing four possible situations, as illustrated in Figure 2. The advantage and risk associated with each of these situations must be carefully assessed to determine the best strategy.

INSERT FIGURE 2

If both the firm and its competitors are taking the proactive strategy, then a fierce war is underway. In this case, the quality of the system is the key factor that determines competitive advantage. The better system will be able to convert its premium into advantage and the firm with less information and financial resources will lose competitive advantage.

In the offense and defense situations, one important concept is the competitive edge life cycle (CELC). Since a firm and its competitors react to each other's strategy, the value and advantage created by a SIS will decay over time. According to the strength of the advantage, the life cycle, as shown in Figure 3, can be divided into four stages: introduction, growth, maturity, and obsolescence. In the figure, the upper half presents the value cycles; whereas the lower half illustrates the competitive advantage. The advantage equals the difference between the values of the innovator and the follower.

Major factors that affect CELC include:

1. Technology progress

   If the technology evolves fast, then the advantage of the early system will be significantly eliminated by the follower's system that provides better services by taking

advantage of the advanced technology.

2. System complexity

   If a system can be easily imitated, its advantage will not be substantial because the competitor will be able to develop a similar or better system quickly.

3. Corporate resources

   The firm with better information and financial resources will be able to develop a better system quicker and hence result in stronger competitive status.

FIGURE 3

Because a substantial amount of resources must be invested in the development and implementation processes, the value of the system at the introduction stage is negative. The advantage at this stage is also negative and the strategic use of IT can be identified as a strategic plan. If the system is successfully implemented, however, the value of the system grows rapidly and the followers start introducing their systems. The strategic plan is converted into a strategic weapon. This stage is called growth.

At the maturity stage, the technology of the innovator's system becomes obsolete. The value of the innovator's system decreases; whereas the value of the follower's system increases. The innovator starts losing advantage. Eventually, the innovator's advantage reduces to a negative value and a new system must be developed to remain competitive. From the industry perspective, the once strategic weapon has become a strategic necessity. That means a firm will not be able to survive in the industry unless the system remains competitive. A good example is the ATMs in banking industry. This system was a strategic plan in the 70s, a strategic weapon in early

80s; but is a strategic necessity for most commercial banks now.

In advantage analysis, therefore, it is very important to evaluate the technology progress, system complexity, and corporate resources and then examine the following two issues for each of the four competitive situations accordingly:

(1) How much advantage the system is likely to generate; and
(2) How long the advantage can sustain, i.e. the length of the CELC.

3. Risk Analysis

Risks represent the uncertainties of outcomes. A good risk analysis can significantly reduce the chance of surprise. Since the strategic use of IT is future-oriented, it would be essential to assess the risks associated with the potential advantage of each situation illustrated in Figure 2. In general, major risks involved in SIS include the following:

1. Technological risks

The technological risks are two-fold. On the one hand, a system using obsolete technology will not be able to create advantage. As the technology advances, on the other hand, the use of IT may actually reduce the switching cost, rather than increase the cost. For example, new technology may make it easier for the followers to imitate the innovator's system or to develop a better system in a very short time. In this case, the innovator will lose advantage.

2. Financial risks

Developing SIS needs a substantial amount of financial resources which may weaken the firm's advantage in other areas. In addition, this is not a one-time project. Given the CELC, new systems must be implemented to alleviate the reduced advantage caused by the obsolescence of the old system. Therefore, unless a firm has a long-term financial commitment on SIS, the chance of failure would be high.

3. Implementation risks

Any IS project is subject to the risk of system development and implementation, such as human resistance. This is also true for SIS because these systems may involve several parties. For example, the self-service ticket machine did not

succeed in implementation.

4. Strategic risks

An innovator may not always result in a better competitive status. An incorrect strategy may create an unanticipated war which causes a substantial loss. Therefore, each situation in Figure 2 must be carefully examined to minimize the strategic risks.

One useful technique for assessing risks is to portray the risk profile for each major factor. Risk profiles indicate to management the range of possible outcomes and the chance that the outcome will exceed a particular level [Delman & Greenberg, 1969]. For instance, Figure 4 illustrates the risk profile for the time required for the follower to imitate a SIS. It indicates the following estimation:

1. It takes at least one year,
2. There is a 50% chance that it may take more than two years,
3. There is a 20% chance that it may take more than three years, and
4. The system should take no longer than four years.

INSERT FIGURE 4

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4. Implementation Process

The VAR analysis provides a sound basis for justifying SIS. Its implementation includes the following procedures:

1. Determine whether the IT supports the generic business strategy of the firm

The strategic use of IT is part of the general business strategy. In order to justify the strategic use of IT, therefore, we must know what strategy makes the business success and how the SIS support this strategy. For example, telecommunication technology may help a distribution-oriented business create new market; but it has little strategic value for a manufacturing-oriented business such as a chemical refinery company. In addition, IT technology which benefits one firm may not benefit another. For instance, IT that results in cost saving may be beneficial to a firm adopting low-cost leadership strategy; but it may not be able to create substantial advantage for a firm that focuses on product differentiation.

2. Estimate the advantages of the system in each of the four situations illustrated in Figure 2

   Different strategies lead to four different competition situations. Since it is difficult to know the competitor's strategy during SIS planning, the advantage and CELC must be estimated for each of the situations. The advantage determined at this step does not take into account the risk factors.

3. Assess the risks associated with each of the four situations

   After estimating the advantages and CELCs, the technological, financial, implementation, and strategic risks must be carefully assessed for these situations. The Delphi technique that has been widely used to develop forecasts of future events is a good method for assessing these risks.

4. Determine the optimum strategy

   Given the advantage and risk in each situation, the management can calibrate the expected advantage. It represents the most likely advantage after considering the risk factors. Based on the expected advantage, the optimum strategy can be determined. For example, if a firm has a relatively weak financial situation which results in high financial risks of SIS, then the expected advantage may suggest that the optimum strategy be defense, although the advantage of offense estimated in step 2 is higher.

CONCLUSION

Because of the power of computers, the strategic use of IT has drawn much attention in the IS area. It is believed that SIS will be able to generate competitive advantage by improving the internal efficiency or increasing the bargaining power. Many real world applications, however, suggest that the strategic use of IT is not without risk. Rather, because of the future-oriented nature, its risk is at least as high as that of implementing a traditional information system. Proper justification is very important.

In this article, a methodology for justifying SIS has been presented. The VAR analysis requires the management to evaluate not only the value of a SIS but also to what extent the value can be converted into advantage and how much risk is involved in the system.

In addition, the analysis suggests that the advantage be determined o
a life cycle basis. The competitor's strategy must also be considere
in justifying the advantage of SIS.

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RESEARCH	BRIEF DESCRIPTION
Kantrow [July 1980]	The importance of integrating technological decisions in a company's strategic thinking.
Gerstein & Reisman [Spring 1982]	System analysis matrix -- assessing the costs, benefits, and strategic risks and rewards by evaluating two aspects: operationally critical and providing competitive advantage.
McFarlan, McKinney & Pyburn [January 1983]	Strategic matrix -- identifying four IS environments by examining the strategic impacts of existing systems and application development portfolio. Three generic strategies: low-cost producer, product differentiation, and focus.
Parson [Fall 1983]	Possible impact of IT on three levels -- impact on product, market and production economics at the industry level, impact on Porter's five competitive forces at the firm level, and impact on the three generic strategies at the strategy level.
Rockart & Scott Morton [Spring 1984]	Value-added chain -- focusing on the interaction between technology and strategy and how to identify IS applications by examining the value-added chain.
Benjamin, Rockart, Scott Morton & Wyman [Spring 1984]	Strategic opportunties matrix -- classifying opportunities along with two dimensions: competitive marketplace vs. internal operation and significant structural change vs. traditional products and processes.
McFarlan [May 1984]	Combining the strategic matrix and five competitive forces to guide IS resources allocation.
Ives & Learmonth [December 1984]	Four strategies for using IST as competitive weapon: beware, safe, attack, and explore, which are based on two criteria: value-added potential and quality of IS resources. Customer resource life cycle -- how IST can be used to directly benefit customers or corporations.
Cash & Konsynski [March 1985]	Interorganizational systems (IOS) and their impact on competition.
Rockoff, Wiseman & Ullrich [December 1985]	Five-phase planning process for identifying opportunities for strategic information systems (SIS). Introduction of the five strategic thrusts.

Figure 1. Summary of Previous Research (cont'd)

Bankos & Treacy [June 1986]	Impact of IT on internal, competitive, and portfolio strategies -- affecting internal strategy by changing capacity, quality, and unit cost in storage, processing and communications, affecting competitive strategy by changing bargaining power and comparative efficiency, and affecting portfolio strategy by changing industry structure and efficiency boundaries.
Henderson & Treacy [Winter 1986]	End-user computing and its competitive advantage.
Clemons & Kimbrough [December 1986]	Strategic weapon vs. Strategic necessity -- not every IST is a sustainable weapon.
Malone, Yates, & Benjamin [December 1986]	Impact of telecommunication technology on market structure -- tradeoffs between production costs and coordination costs favor market to hierarchies.
Vitale [December 1986]	Analysis and management of the risks associated with IST uses.
Vitale, Ives & Beath [December 1986]	Adaptive approach for adopting IT as competitive weapon -- the top-down approach is not satisfactory in a turbulent environment.
Learmonth & Ives [Winter 1986-87]	Reorganization of the customer resource life cycle into four phases: requirements, acquisition, stewardship, and retirement.

Figure 1. Summary of Previous Research

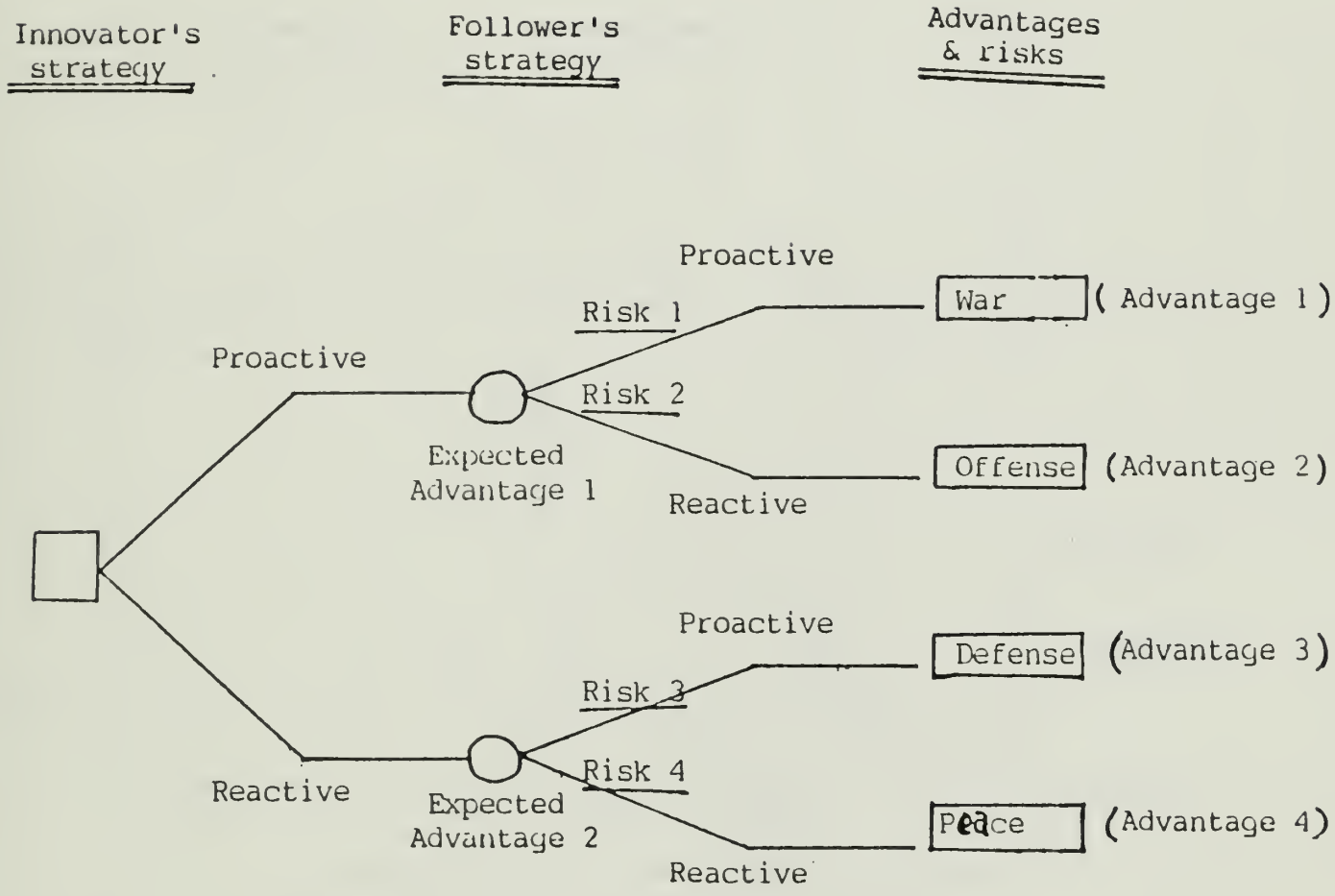

Figure 2. Four Competitive Situations

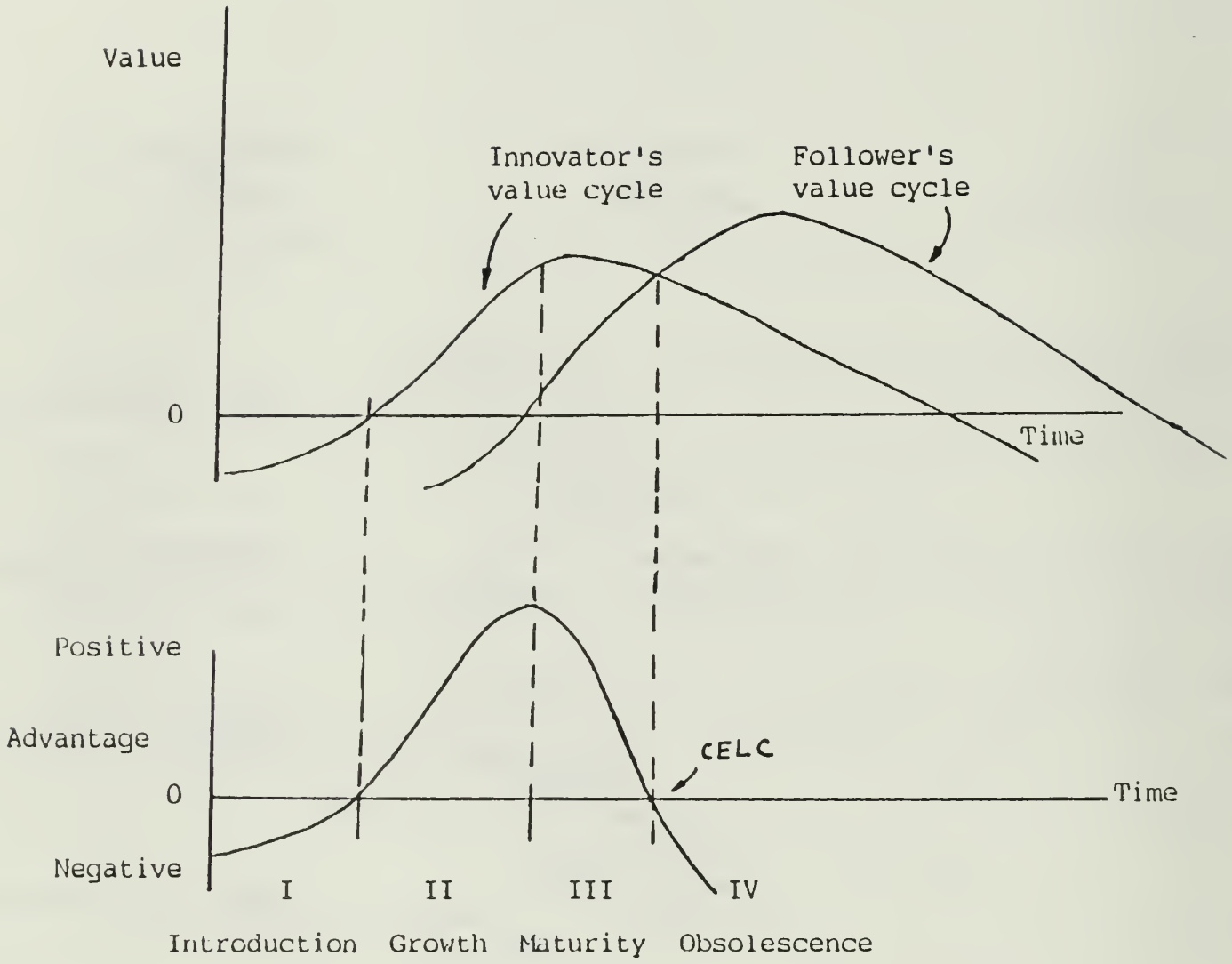

Figure 3. Competitive Edge Life Cycle

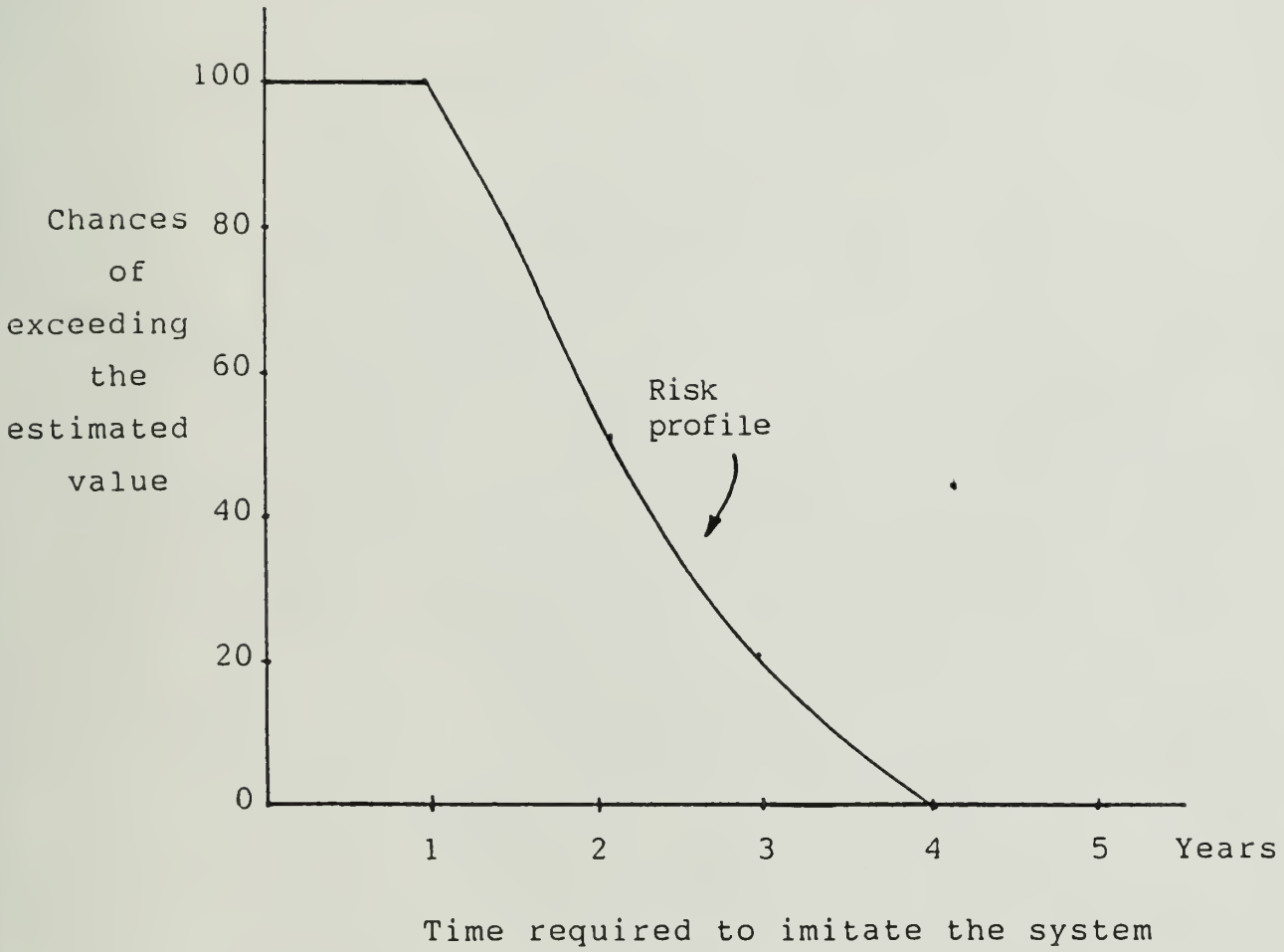

Figure 4. A Sample Risk Profile